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(54) PORTABLE POWER TOOL OF THE TYPE WHICH IS DRIVEN BY AN INTERNAL COMBUSTION ENGINE

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Granted to Skil Canada Ltd., Toronto, Ontario, Canada

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No. OF CLAIMS 2

A primary object of the present invention is to provide novel improvements in a portable power tool of the type which is driven by an internal combustion engine.

Another object of the present invention is to provide in a power tool of the type described an on-off switch of simplified construction, which switch, in the "off" position thereof, grounds the ignition wire of the internal combustion engine for shutting down the latter.

Still another object of the present invention is to provide a portable power tool of the type described which includes an intake member having a dome-shaped formation over the carburetor intake aperture to prevent discharge of raw fuel from such aperture.

Another object of the present invention is the provision of a new and improved portable power tool of the type described which includes a generally planar and substantially horizontally disposed filter element, which filter element cooperates with a housing shell such that all of the ambient air entering the carburetor intake aperture must pass upwardly through said filter element thereby reducing the tendency of such element to clog as foreign materials tend to drop from the underside thereof.

Still another object of the present invention is to provide a new and improved choke in a power tool of the type described, which choke automatically causes partial opening of the throttle in response to movement of the choke to its "choked" position.

Another object of the present invention is to provide a new and improved fuel pick-up system in a power tool of the type described, which system includes a flexible fuel

line in the gas tank of the internal combustion engine, such fuel line having a free end mounting a filter pad with a surface area substantially in excess of the cross-sectional area of the fuel line.

These and other objects and advantages of the invention will become apparent from the following specification disclosing a preferred embodiment shown in the accompanying drawings.

Fig. 1 is a perspective view of a portable chain saw embodying the present invention;

Fig. 2 is an enlarged, fragmentary perspective view of the chain saw with certain parts removed for better illustration of the invention;

Fig. 3 is an enlarged, fragmentary section taken generally along the line 3-3 of Fig. 1 with certain parts being broken away for better illustration of the invention;

Fig. 4 is an enlarged perspective view of a shell member showing the same detached from the power tool and in an inverted position for illustration of a filter element mounted in the shell;

Fig. 5 is a section taken along the line 5-5 of Fig. 4;

Fig. 6 is an enlarged, fragmentary top elevation of the power tool with certain parts being removed for better illustration of the choke, the latter being shown in the "run" position;

Fig. 7 is a top plan view similar to Fig. 6 and showing the choke in its "choked" position;

Fig. 8 is an enlarged, fragmentary vertical section taken through the fuel tank forming part of the portable chain

saw shown in Fig. 1;

Fig. 9 is an enlarged section taken along the line 9-9 of Fig. 8:

Fig. 10 is an isometric view of the intake member which is mounted over the fuel intake aparture of the carburetor; and

Fig. 11 is a section taken along the line 11-11 of Fig. 3.

The present invention is shown as embodied in a portable chain saw which is powered by a gasoline operated, internal combustion engine of the single cylinder, four-cycle type. It is understood that the invention is not to be limited for use in the particular power tool described and illustrated herein; the invention has applicability in other portable tools which are operated by small and light-weight internal combustion engines.

The portable chain saw includes a housing, generally designated 10, containing a gasoline powered, internal combustion engine. The housing includes an opening 11 in one side thereof exposing cooling fins 12 on the cylinder of the internal combustion engine as well as an exhaust manifold 14 having a plurality of slots 15 therein to discharge the exhaust gases downwardly away from the operator's face. The internal combustion engine has an output shaft mounting a sprocket for powering the cutting chain. These parts, which are not illustrated herein, are well known both in terms of construction and operation to those skilled in the art. The cutting chain is guided in an endless path along the periphery of an elongated blade 16 which is more or less diagrammatically illustrated. A chain oiling system, which is preferably of

the manual/automatic type disclosed and claimed in the co-pending Canadian patent application of Frank C. Schrack et al, Serial No. 110,399, filed on April 15, 1971, and assigned to the assignee of the present application, includes a manual oiler button 17.

The housing 10 mounts a rearwardly extending handle, generally designated 18, and a transversely disposed handle, generally designated 19, adapting the tool to be held by a single operator and manipulated by him in a variety of positions to perform various and sundry cutting operations. The forward portion of the housing 10 includes a tank 20 partitioned to define a fuel tank and an oil tank accessible by removing caps 22, 23, respectively.

Referring primarily to Figs. 1 through 3, the handle 18 is defined by a lower part 25 and an upper part 26, which upper part is in the form of a shell of inverted, U-shape cross-section, and preferably formed of a dielectric material. The handle part 26 includes an aperture 27 which is formed in a planar portion 26a of this part, which portion serves as a slideway for a switch actuator button 28. This actuator has an arrow-like formation on the upper surface thereof and preferably bears the indicia "on" and "off" to indicate to the operator that the internal combustion engine may be started when the button 28 is slid in the direction of the arrow and will be shut down when the actuator is slid in the opposite direction.

The button 28 includes an integral, depending, lug 28a extending through the aperture 27, which lug includes a notch 28b. A bridging contact in the form of a bent strip 30 is received within this notch. The notch 28b is so arranged

that the bridging contact is in snug sliding engagement with the undersurface of the planar portion 26a whereby the actuator 28 and the strip 30 are secured together for sliding movement in unison and the actuator 28 is retained in place on the handle part 26. The bent strip includes two integral legs 30a, 30b having respective rounded portions 30c and 30d at the distal ends thereof.

The ignition wire extending to the spark plug of the internal combustion engine has an insulated portion 32 terminating in a cylindrical contact formation 33. This contact formation is mounted in a dielectric member 34, which member has an upstanding ear 34a bent to extend over a portion of the contact 33 intermediate the ends thereof. The handle part 25, which is made of metal and which is connected to the housing and/or frame structure mounting the internal combustion engine, includes an upstanding wall portion 35 containing an upwardly facing recess 35a.

When the actuator button 28 is slid in the direction of the arrow to its "on" position, the bridging contact formations 30c, 30d are in their solid line positions illustrated with the formation 30c separated from the contact 33 and in engagement with the dielectric ear portion 34a. Accordingly, the ignition wire 32 is not grounded and the tool may be started. When the actuator button 28 is slid to its "off" position, the formations 30c and 30d occupy the broken line positions illustrated thereby grounding the contact 33 with the housing and/or frame structure of the power tool for shutting down the internal combustion engine.

The on-off switch just described is of simple construction and can be incorporated in a power tool of the type

described at a very minimum cost. This switch is actually constituted only by two parts, viz., the actuator 28 and the bridging contact 30, as the switch makes use of an integral part of the handle, i.e., the planar portion 26a, to constitute the switch casing or housing.

The housing 10 includes a generally rectangular shaped opening in the upper portion thereof defined by right angle shaped walls 37 each having a pair of apertures 38, 39. The walls 37 cooperate with the underside of the lower handle part 25 to define another aperture 40; this aperture, and the other apertures just mentioned, permit the flow of ambient air to the underside of a filter element as will be explained hereinbelow.

The lower handle part 25 includes an integral, forwardly disposed extension or shelf 25a forming part of the housing or frame structure of the power tool. A carburetor 42 of the internal combustion engine is mounted under the housing shelf 25a. This carburetor includes an air intake aperture 43 (Fig. 6).

A one-piece choke member, generally designated 45, includes a finger engageable portion 46 on one end of a cylindrical portion 47. This cylindrical portion joins with an extension 48 of a planar portion 49, the latter having a circular opening 50 interrupted by a small notch 51. The planar portion 49 is slidably mounted on the shelf 25a for sliding engagement between the "run" and "choked" positions shown respectively in Figs. 6 and 7. The choke 45 is guided during such sliding movement by reception of the cylindrical portion 47 in a recess 25b formed in the handle part 25.

When the choke is in its "run" position, the

carburetor intake aperture 43 is uncovered by the opening 50; when the choke is in its "choked" position, the intake aperture 43 is substantially closed, the latter communicating only with the small notch 51 in the planar portion 49 of the choke. It is noted that the choke 45 includes a camming formation 52; the purpose of this formation will be explained hereinbelow.

An intake member, generally designated 54, is mounted on the upper surface of the shelf 25a by means of a pair of fasteners 55. The intake member 54 includes suitable guideway surfaces (not shown) on the underside thereof so as to aid in guiding the planar portion 49 of the choke during its reciprocal movement between the "choked" and "run" positions. The intake member includes a dome-shaped formation 56 supported by four legs 57, which legs define four intake openings 58. These openings in the intake member, a portion of which is hollow is shown in Fig. 3, are in communication with the carburetor intake aperture 43. Thus, the dome-shaped formation 56 is mounted over and above the central portion of the aperture 43.

The intake member 54 includes a pair of rearwardly extending legs 60 defining upwardly facing journal formations 61. These formations cooperate with complementary shaped journal formations 62 formed in the handle part 25 to receive the oppositely disposed trunnions 64 of a throttle-trigger, generally designated 65. These cooperating journal formations on the intake member 54 and housing part 25 mount the throttle-trigger for pivoting or rocking movement about an axis defined by the trunnions 64; it will be appreciated that this construction provides a simple and very satisfactory pivotal movement for the throttle-trigger.

The throttle-trigger includes a first arm portion 67

defining the finger engageable trigger and another arm portion 68, the distal end thereof being pivotally connected to an operating arm 69 forming part of the carburetor 42. The arm portion 68 includes a cam formation 70. It will be understood that when the trigger 67 is squeezed for rocking the throttle-trigger 65 in a counterclockwise direction as viewed in Fig. 3, the resulting movement of the carburetor arm 69 will open the carburetor for increasing the speed of the internal combustion engine.

The throttle-trigger 65 is shown in its "idle" position in Fig. 3 in which position the cam formation 70 is disposed in the path of movement of the cam formation 52 on the choke 45. When the choke is moved from its "run" position (Figs. 3 and 6) toward its "choked" position (Fig. 7), it will be understood that the cam formation 52 comes into engagement with the cam formation 68 thereby rocking the throttle-trigger 65 slightly toward the "fast" position. Accordingly, when the choke is operated prior to starting of the internal combustion engine, the carburetor will be automatically opened a predetermined extent to facilitate starting of the engine.

A shell 72, best seen in Fig. 4, includes a pair of tabs 73 for reception in recessess 74 formed in an upstanding housing wall 75, the latter having ends joining with the walls 37. The shell 72 includes an aperture 76 receiving a fastener 77 which is threadingly received in a bore 78; this bore is formed in the handle part 25. The shell includes a transversely extending wall 80 having an edge 80a. Opposite ends of this edge join with ledges 81 formed on the inner surfaces of the side walls of the shell 72. A generally planar filter element 82 is mounted within the shell 72 against the edge 80a

and the ledges 81. This filter element extends forwardly to join the forwardmost portion of the shell 72 adjacent the tabs 73 as noted in Fig. 4. The inner surfaces of the shell side walls include ribs 83 to aid in detachably retaining the filter element 82 in place.

The filter 82 cooperates with the shell to define an enclosed chamber 85. The filter element includes a centrally disposed hole 86 in communication with this enclosed chamber. The shell 72, which is preferably of plastic molded construction, includes a plurality of integral fingers 87 to aid in supporting the filter 82 in spaced relation with the shell 72 so as to define the chamber 85.

When the shell 72, which has the filter element mounted therein to constitute a subassembly, is attached to the power tool by means of the tabs 73 and the fastener 77. the dome-shaped formation 56 of the intake member is received through the hole 86. The underside of the filter 83 adjacent the periphery of the hole 86 rests on the annular shoulder 89 formed on the intake member 54. Accordingly, the intake openings 58 are disposed within the chamber 85. As noted in Fig. 1. when the shell 72 is secured in place, the side walls thereof join smoothly with the wall portions 37 on the housing.

Ambient air entering the intake aperture 43 of the carburetor is drawn through the apertures 38, 39 and 40. The air passes upwardly through the filter element 82 to the enclosed chamber 85. The filtered air then passes through the intake openings 58 and enters the intake aperture 43 of the carburetor. When the shell 72 is mounted in place, it is noted that the filter element 82 defines the base of the cham-

ber 85. Because of the upward travel of the air through the filter 82, which is generally planar and substantially horizontally disposed when the power tool is in or near its normal operating position, foreign materials removed from the ambient air by the filter tend to drop away from the underside of the same thereby reducing the tendency of the filter to become clogged. Of course, this filter element may be readily replaced by removing the shell 72.

The dome-shaped formation 56, which is disposed over the central portion of the carburetor intake aperture 43 in vertical spaced confronting relation with the latter, eliminates so-called "spit-back" of raw fuel during operation of the internal combustion engine. As is known to those skilled in the art of operating a four-cycle internal combustion engine of the type embodied in the power tool shown herein, a ramming effect is created by the piston as it covers the fuel intake opening in the cylinder during the compression stroke, and this ramming effect sometimes causes discharge of small amounts of raw fuel from the intake aperture of the carburetor. The domed formation 56 deflects any such raw fuel back into the carburetor.

Referring to Fig. 8, the housing 10 of the portable chain saw includes a fuel tank or space 90 defined by side walls 91, 92, upper and lower walls 93, 94, respectively, a rear wall 95 and a front wall (not shown). The side wall 91 is shaped to provide an enlarged area at the bottom of the fuel tank 90. For additional details of the housing structure constituting the fuel tank 90, reference may be had to the aforementioned Schrack et al. application.

A flexible fuel line 97, which may be made of rubber.

has one end thereof connected in a fitting 98; it is understood that such fitting places this end of the fuel line in communication with suitable passageways or pipes leading to the carburetor 42. The fuel line 97 is connected with the power tool only at the fitting 98; the other end 99 of the fuel line is free.

Another fitting, generally designated 100, includes a head portion 101 and a stem portion 102, which stem portion is bifurcated by a slot 103. The stem portion adjacent the head 101 is received within an opening 104 formed in a filter pad 105, the latter being preferably in the form of a parallelepiped. The remaining part of the stem portion 102 is received within the free end 99 of the flexible fuel line. A washer 106 may be provided to cooperate with the head 101 so as to facilitate securing of the filter pad 105 to the free end of the flexible fuel line.

The fuel in tank 90 passes through the interstices of the filter pad 105 and enters the slot 103 for passage through the fuel line 97 to the carburetor 42 of the internal combustion engine. The filter pad 105 is made of an absorbent material; such material may be Nylo Press No. 48, for example. The filter pad provides a capillary action to a certain extent which aids in fuel flow to the internal combustion engine. The surface area of the filter pad 105 is substantial as compared with the size of the inlet opening defined by the slot 103 for improved performance of the filtering function.

It will be understood that the filter pad 105 is of substantial size as compared to the lowermost portion of the fuel tank 90. Because of the flexible nature of the fuel line 97, the gasoline-soaked filter pad 105 tends to seek the

lowermost position possible as the portable chain saw is manipulated through various positions during operation. In other words, when the tank 90 has been partially drained, such that only the lowermost portion thereof contains fuel, the pad 105 tends to remain immersed in pockets of fuel in the tank thereby to minimize the possibility of fuel starvation during handling of the tool. The fact that the filter pad 105 is capable of absorbing a quantity of fuel tends to minimize the possibility of fuel starvation should the pad momentarily be above the liquid fuel level as, for example, when the tool is held in a position substantially at variance with its normal operating position and when the level of fuel in the tank 90 is rather low.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a portable power tool having a housing mounting an internal combustion engine of the type which is shut down by grounding of the ignition wire, the improvement comprising:

(a) said housing of said power tool having an exterior wall, which wall includes an aperture;

(b) an actuator mounted in said aperture for movement back and forth between "on" and "off" positions;

(c) a bridging contact carried by said actuator for movement therewith, said bridging contact engaging said wall and thereby serving to retain said actuator in said aperture for movement therein;

(d) said ignition wire having a contact portion fixedly mounted adjacent said bridging contact by means insulating said contact portion from said housing of the power tool, which housing has a portion thereof adjacent said contact portion; and

(e) said bridging contact including a pair of spaced contact surfaces in respective engagement with said contact and housing portions when said actuator is in said "off" position, said bridging contact being in spaced relationship with said contact portion when said actuator is in said "on" position.

2. The improvement according to claim 1 further defined by:

(a) said wall forming at least a part of a handle for said power tool;

(b) said actuator including a finger engaging portion slidable on an exterior surface of said wall and having another portion extending through said aperture into the interior of said handle, which another portion includes a notch disposed interiorly of said handle; and

(c) said bridging contact being in the form of a bent strip having a part thereof received within said notch so as to connect the strip to the actuator and to retain these members on the handle for sliding movement in unison relative thereto.

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FIG. 1

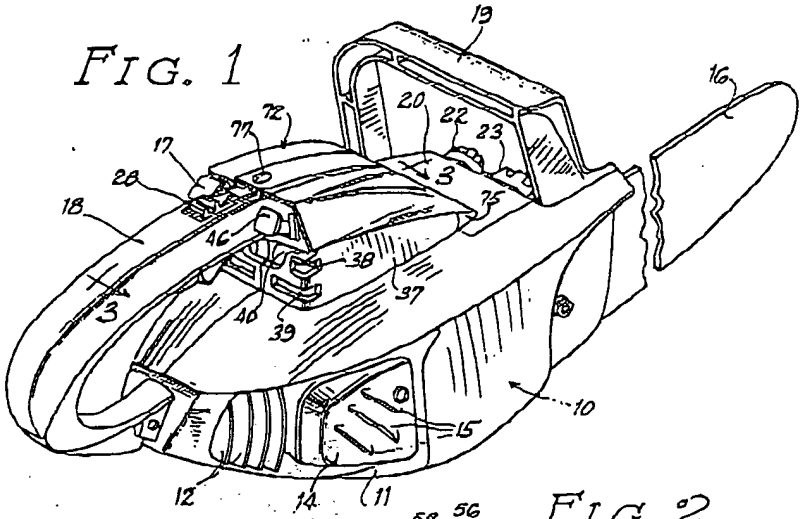

FIG. 2

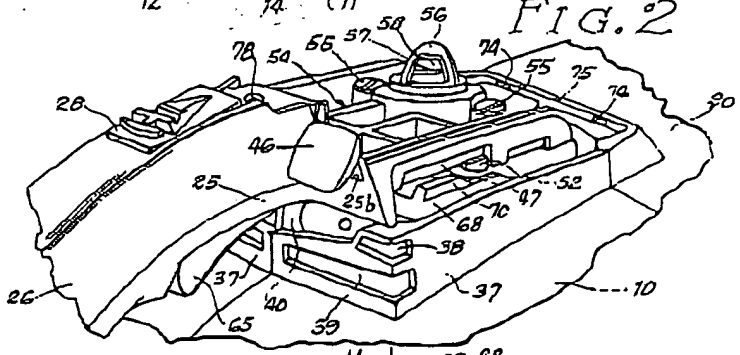

FIG. 3

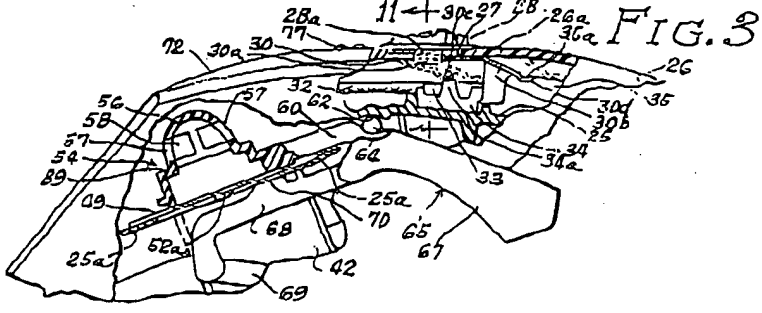

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FIG. 4

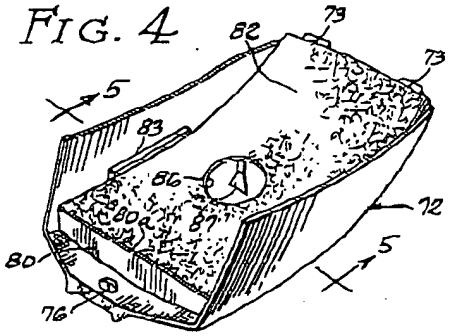


FIG. 5

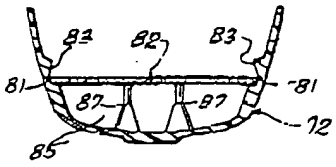


FIG. 6

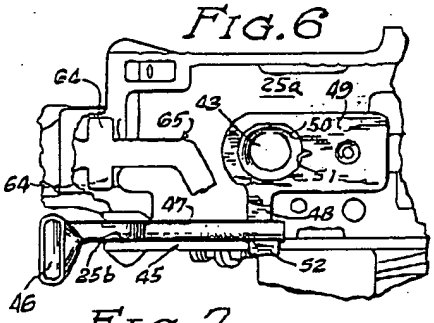


FIG. 8

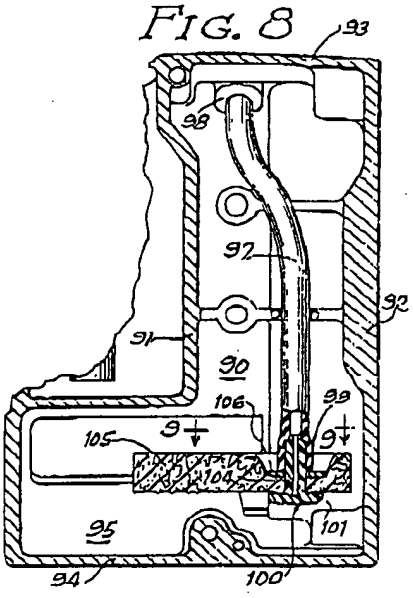


FIG. 7

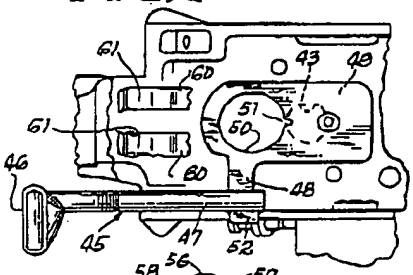


FIG. 9

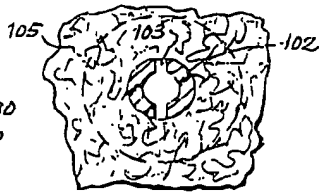
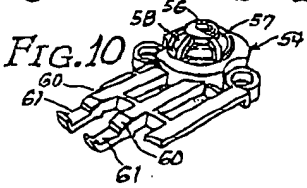


FIG. 10



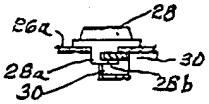


FIG. 11